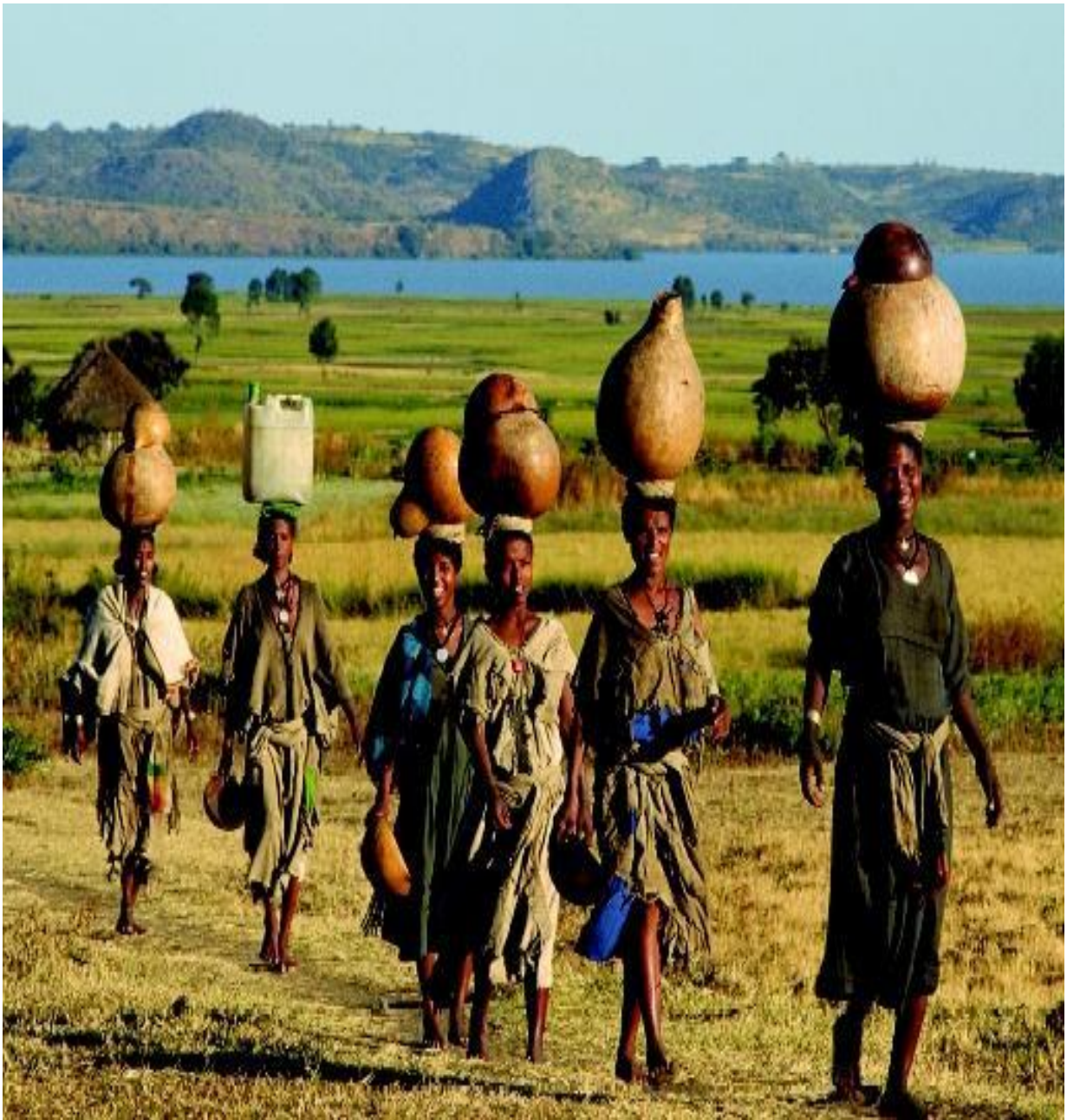


## A LITERATURE REVIEW ON GENDER IN WATER AND RAINWATER MANAGEMENT



(INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE, ILRI)

*Pauline Wavinya, Elizabeth Waithanji and Jemimah Njuki*

## Table of Contents

1	GENDER AND WATER MANAGEMENT.....	3
1.1	Overview .....	3
1.2	Gender and Integrated Water Resources Management (IWRM) .....	3
1.3	Gender mainstreaming in water management.....	3
2	GENDER, WATER AND POVERTY .....	4
2.1	Women, land, water ownership and tenure .....	5
3	GENDER, GOVERNANCE AND WATER RESOURCES MANAGEMENT .....	6
3.1	Challenges of gender approaches in water governance .....	6
3.2	Women, water and decision making .....	7
4	GENDER, SANITATION AND HYGIENE.....	9
4.1	Gender divisions of labour and responsibilities .....	9
5	GENDER AND RAINWATER MANGEMENT.....	11
5.1	Purpose and objectives of the research on rainwater management.....	11
5.2	Importance of rainwater management.....	11
5.3	Examples of rainwater technologies adopted in Africa .....	12
5.3.1	Rainwater Harvesting.....	13
5.3.2	Conservation Agriculture.....	14
5.3.3	Watershed Management.....	16
5.3.4	Sand Dams .....	18
5.3.5	Terraces.....	19
5.3.6	Shallow Wells .....	21
6	BIBLIOGRAPHY REFERENCES.....	23

# **1 GENDER AND WATER MANAGEMENT**

## **1.1 Overview**

This review examines women's role in managing water resources and the constraints they face in gaining access and control of water resources. The review offers recommendations on how to improve women's access to water resources through equitable development and gender mainstreaming. It should be noted that women secure access to water resources is central to attainment of Millennium Development Goals.

## **1.2 Gender and Integrated Water Resources Management (IWRM)**

Gender refers to the different roles, rights, and responsibilities of men and women and the relationships between them. Gender is generally associated with unequal power and access to choices and resources. Integrated Water Resources Management (IWRM) is a systematic process for the sustainable development, allocation, and monitoring of water resources (GWA, 2006). IWRM is a cross-sectoral holistic approach to water management, in response to the growing competing demands for finite freshwater supplies. It is an approach that aims to ensure the coordinated development of water, land and related resources to optimise economic and social welfare without compromising the sustainability of environmental systems (Global Water Partnership, 2000).

The principles of integrated water resources management include:

- Recognising women as central to the provision, management and safeguarding of water.
- Treating water as an economic, social, and environmental good.
- Water policies should focus on the management of water as a whole and not just on the provision of water.
- Governments should facilitate and enable the sustainable development of water resources by the provision of integrated water policies and regulatory frameworks.
- Water resources should be managed at the lowest appropriate level (GWA, 2006)

## **1.3 Gender mainstreaming in water management**

Gender mainstreaming in water management recognizes the existing divisions of labour, inequities in rights and power relations over resources and the need to adjust interventions and policies to address these issues. Gender mainstreaming is a strategy for making the concerns and experiences by women, as well as men, an integral part of a identification , planning, implementation, monitoring and evaluating stages of

programs so that both women and men benefit equally and inequalities are not perpetuated (GWA)

Water deprivation is a major concern involving both the quality and the availability of water. According to the United Nations Food and Agriculture Organization, over 230 million people live in 26 countries classified as water deficient of which 11 are African countries. Most of the world's 1.2 billion poor people, two thirds are women who are affected most by water scarcity. Women are most vulnerable because they do not have access to safe and reliable supplies of water for productive and domestic uses. The majority of these rural poor are dependent on agriculture for their livelihoods (Women and water)

In the area of water resources management, water supplies are threatened by:

- Degradation from over exploitation of water resources by households and industries
- A growing competition for water resources from different sectors which include the agricultural sector, power generation companies and domestic use
- Inequitable distribution of benefits and burdens to water resources between men and women
- Poor involvement of men and especially women in projects has hindered objectives aimed at addressing sustainability in water resource management
- Inadequate operation and maintenance of water resources by government, private sectors and the community at large (GWA, 2006)

Addressing gender and water together acknowledges the issues in use, access and management of water resources. To manage water resources effectively and sustainably it is important to understand the different roles played by men and women in water management. Re-evaluating how both women and men manage water resources will allow us to:

- Share benefits from use of water equitably between men and women
- Make progress towards a more sustainable use of water
- Maximize on social and economic benefits from sustainable use of water for women and men (UNDP et al, 2006)

## **2 GENDER, WATER AND POVERTY**

Provision of water is essential to all human beings who depend on it for their everyday life activities. However, lack of access to good quality water is exacerbating the poverty cycle levels, the spread of water borne diseases and gender inequities (Khosla and Pearl, 2003). Water provides a means for sustainable development, poverty eradication, and improved education for girls and better health for children reducing child mortality

rates. Yet there are still 1.1 billion people without access to safe drinking water and 2.2 billion without access to adequate sanitation (GWA, 2006)

The poverty levels are proliferating worldwide and the most vulnerable groups are women and children. Women experience poverty differently from men, as they are generally treated unequally in the allocation of water resources and others like land. Women also work two-thirds of the world working hours, they produce half of the world's food, and yet they earn only ten percent of the world's income and own less than one percent of the world's property (UN Millennium Campaign, 2005)

Women manage water resources not only for productive purposes like agriculture but also for domestic use like cleaning and cooking. Sanitation and hygiene for good health from water consumption is their sole responsibility. Women often play an active role in the construction, operation and maintenance of water resources. Women realize that securing water for both productive and domestic uses is critical in achieving food security and improved rural livelihoods. However, despite the active role women play in reducing food security they often face constraints to access water resources. The following are the constraints:

## **2.1 Women, land, water ownership and tenure**

In most countries land and water rights are closely related, although water is a public good, its use is now under permits, concessions and other tenure systems. Irrigation and rain-fed land is the main source of livelihood for many rural populations. However, women have much less access to this essential asset than men due to customary laws and informal legal systems built-in inequalities, a recipe for aggravating gender disparities in ownership and rights that ultimately affect women progression. The unequal distribution of land and water rights is a major determinant of poverty.

Since land is a primary means for both subsistence and income generation in rural economies, access to land and security for women is of primary concern since it is a means of eradication of poverty. Land as a basic livelihood asset would provide rural women with the opportunity to decide how they will use the water, which they need in their farms either by adopting irrigation schemes that do not require too much water usage or adopting water conservation techniques. Frequently, women have only use rights, mediated by their husbands however, those rights are highly precarious because ownership of land for the men means that the involvement of water is related to livestock and agriculture which generates income for the household yet women's efforts to fetch water is not recognized. Often the work women do in the farms goes unpaid (WEDO, 2003)

Landless rural women depend on common property resources and in cases where there is overuse of water resources this becomes a serious threat to rural livelihoods and food security. Securing access to land among poor female farmers can lead to secure water rights for women. This will also implies access to credit services from banks and other institutions. A survey carried out shows rural women in Kenya, Malawi and Zambia



receive one percent of credit which is directed to agriculture (IFAD, 2007). Access to credit implies increased enrolment of children in schools because women can engage in profitable economic activities where they could have control over the income they generate and pay school fees for their children.

Membership of Water User's Association (WUA) is often linked to land ownership which means there is a low participation of women in these groups and therefore they do not benefit from the groups. These associations fail to address the multiple uses of water and how various constraints of allocation to water resources limit women's growth socially and economically. The water user's association therefore tend to target men land owners yet women are the primary users of water. Access to land rights will also provide women to access to agricultural extension agent's services like training on how to conserve and maintain water resources, how to develop techniques for water use in irrigation and participation in water community institutions (IFAD, 2007).

Water management programs fail to take to account women's concerns about the multiple uses of water such as; agriculture, domestic use, health and sanitation while men's water use is centered towards livestock and agriculture. Also, the international debate continues to address land and water issues separately and in many countries these issues are increasingly being decoupled (IFAD, 2007). Empowering poor rural women with adequate water rights means strengthening their access to water for both domestic and income generating uses. Women's improved access to water can be negotiated easily through ensuring that women like men have an equal opportunity to own and control land. With the growing competition of water resources securing water rights ensures that there is food security for households (Barbara Van Koppen, 2001).

### **3 GENDER, GOVERNANCE AND WATER RESOURCES MANAGEMENT**

Good governance of water resources plays a significant role in improving the rural livelihoods for people especially the rural poor. Improved management of water resources can lead to equitable water resources development and access to all. Weak water management impacts men and especially women negatively through unreliable services, limited access to services and higher costs for inefficient and ineffective services which are not felt by the wealthy people. Water crises in developing countries reflects on poor governance from institutions which is now coupled with persistent poverty levels and inadequate water supply for vulnerable groups, women (GWA, 2006).

#### **3.1 Challenges of gender approaches in water governance**

Water governance refers to the political, economic and social systems that are meant to regulate the development and management of water resources and provision of water services of different levels of the society. The involvement of women and men in integrated water resource management planning is necessary to achieve sustainable water development. Water has been classified as an economic good and has a cost

attached to its development, distribution and maintenance. While others are able to pay for water in many urban areas, poor women in rural settings are often not able to afford the tariffs. A higher price for water makes for economic water use and it also brings the risk that water is priced out of bounds for the lower income groups. In farmer households this means that women no longer have access to water for their production. Yet water access to safe and affordable water is a fundamental right for people. In many cases there is an opportunity cost when it comes to this; children (girls) have had to drop out of school because women are spending the little income they have to pay for water. This has led to the use of piped water which serves households because the tariffs are low, however this has also meant they have to spend their income in paying vendors for the operation and maintenance of water pipes (GWA, 2006).

While privatization may offer better governance of water resources, it has also paid little attention to gender issues. Poor women as managers of provision of water for household have been first to signal problems of water privatization which include; price of water hiking consuming a high amount of their income, water cut-offs from unpaid bills, deterioration of water quality. In some instances, women from poor households have been forced to decide between paying for water and feeding their children (WEDO, 2003). These women from poor households may be placed at a high accessibility to clean water but they may be forced to use contaminated water that is free rather than clean water which they cannot afford. This impacts the health of the household which results to higher costs in health care that is the sole responsibility of women.

Governments do have a responsibility to ensure that water is provided to meet basic human needs and to maintain ecosystem integrity, whether through regulating pricing policies, general taxation, borrowing from banks or international assistance. It is also important to incorporate gender perspectives into all policies and programmes aimed at sustainable development. Such programmes will be more sustainable and more equitable if both women and men are involved in their planning and implementation stages (United Nations, 2004).

### **3.2 Women, water and decision making**

Women are most often the collectors, users and managers of water in the households. Women use water for domestic purposes and other productive uses to ensure improved livelihoods for the household. At least half of the world's food is grown by women farmers in which water has a big role in the production process. However, even though women play a vital role in food production for the world, they continue to remain among the disadvantaged populations when comes to access of water resources. Easier access to fresh water resources can improve living conditions for the rural poor. Girls have had to drop out of school in order to assist their mothers to walk long distances (upto six kilometres) in such of fresh water for the household which takes up have almost half the day. Lack of access is an obstacle to their right to have access to formal education (UNESCO, 2004).

Women's considerable knowledge of water resources, including quality, reliability, operation and maintenance, is too often not taken into account by project planners and decision makers (governments) who ignore that this hidden knowledge of water resources by women is one of the major keys to the success of water development and sustainability. It is now recognized that the exclusion of women from the design, planning and decision-making of water supply in developing countries is a major obstacle to the improvements of their livelihoods. The absence of women in decision making process results in failed policies which have not addressed women's needs and concerns. Involving women at all levels of the decision making process is vital to achieving a more equitable provision of water services. Considering that women are the main users of water, in rural areas as well as urban areas, their participation as water scientists, engineers and policy makers is an urgent morally imperative (UNESCO, 2004).

The 'water world' has for a long time been dominated by men. This means that the political, social and economic aspects of water management are not gender neutral. Careers and training in water management tend to be dominated by men too. The gender distribution in water projects, extension services and group discussions shows a marked discrepancy between the numbers of men to women. In 2004, the World Water Council had 32 board members, of whom only 3 were women. These statistics are representative of the breakdown of decision makers in most leading organizations in the 'water world'. These organizations failed to address the water needs and concerns of the main water user, women (United Nations, 2004). Efforts by women to engage actively in water management, has been difficult as they have had to overcome specific social barriers that restrict their participation in community-based forums or public consultations that can influence policies on water. However affirmative action policies and gender-biased laws in countries like South Africa has proved to be a successful means of empowering women (United Nations, 2004).

Membership in Water User's Association (WUA) is often linked to land ownership which means there is a low participation of women in these groups. Women who do have access to WUAs have restricted active participation because of men's presence in these associations. Some customs may restrict women to talk in public meetings in front of male elders. Women's therefore can not raise their concerns and needs which halts water development. Female headed households however, find it easier to approach women committee members if they are facing water distribution challenges, and women are more efficient in collecting water user fees and resolving WUA conflicts (GWA, 2006).

Power relations between men and women also influence the way water is allocated and the choice of technology. Usually it is men who make the decisions over how surplus money will be used. For example an irrigated pipeline is generally associated with productive use of water, and men have more influence than women over the utilization of these resources. A good example, women farmers in rain-fed agriculture areas in Africa use less water for nutritious crops than is used by male farming systems growing



one or few crops which require a lot of water like rice and sugar. A hand-dug well is generally associated with women's domestic use of water. While this can be considered productive, and provides benefits to women it may not be given a priority (GWA, 2006).

Community management has been identified as a mechanism for ensuring effective governance at the local level, especially for common water resources. Involvement of the entire community will aim at improving equitable access and distribution of water resources. Water User's Associations should also aim at targeting women as they are the primary managers of water resources. It is important that women have a strong voice to ensure that their views are taken into account. This means promoting the involvement of women in decision making processes from community levels to the highest levels of water management.

## **4 GENDER, SANITATION AND HYGIENE**

Water supply, sanitation and hygiene promotion and education must be considered as an integrated unit if real progress is to be made in improving the health and the well-being of the poor. Sanitation and health are subjects that have been intimately associated with women and water supply or the lack of it. It has been noted that globally, more people have access to water but the water may not be of good health quality. According to the WHO-UNICEF Joint Monitoring Programme, at the end of 2002, 1.1 billion people lacked access to safe drinking water and 2.6 billion had poor access to sanitation. Safe water and basic sanitation are major determinants of health and as such rural development (GWA, 2006).

### **4.1 Gender divisions of labour and responsibilities**

Women play a major role in operating, managing and maintaining communal water supply. Women are responsible for the regulation and control of the social use and safe maintenance of water resources. Water and sanitation facilities are used by both women and men, but maintenance of these are mostly viewed as a female responsibility. If water resources become scarce or contaminated, women must look for other alternative water sources. Water collection is the sole responsibility of women and girls in developing countries. Women determine the appropriate domestic use of water, but are rarely involved in decision-making processes on sanitation and hygiene issues. For example women restrict livestock from drinking water at water resources, though men are in charge of livestock in most rural settings. Another good example of how little right they have on sanitation and hygiene issues is for example, the availability and placement of toilets has a huge impact on women, but in many communities, women must walk a long distance to use facilities, often risking their personal safety. This is justified by the increased incidence of sexual and physical assault especially when toilets are in a remote location. Since their managerial work of water resources is performed informally, women's needs are not taken into account during political and social processes (WEDO, 2003).

Although women's vital role is at stake to provide water for their households, The World Health Organization estimates that 80 percent of all sickness in the world is attributable to unsafe water and sanitation. Water-borne diseases kill 3.4 million people, mostly children. Millions are affected by diarrhea, malaria, schistosomiasis, arsenic poisoning, trachoma, and hepatitis all which are preventable if only women had access to information on how to treat unclean water. Access to this information is however limited as women have limited time to join Water User's Associations because of the multiple roles they play in the household which include providing food for the family, collecting water which takes up to six hours of their time depending on the location of the resources. Men rarely provide water for the household and if they do it is for two uses, livestock and agriculture.

Women bear the main burden of caring for those who are ill. In developing countries, women have lost their children because of drinking unclean water. Women have had to use the little income they have to pay for medical services for their children, husbands and themselves. This has limited them from investing in income earning activities that could earn them more income which they use to provide education to their children. Men consider that the role of taking care of the ill in the household is a woman's responsibility and they may choose not to contribute to medical costs. In addition women's health and well being exert an important influence on their children, families, communities because they rely on women for management of water resources.

About 1 in 10 school-age African girls do not attend school during menstruation or drop out at puberty because of the absence of clean and private sanitation facilities in schools. There is also a need for gender sensitive education on proper sanitation and hygiene practices and this must be made available to men as well as women. With limited investment, education could have a tremendous impact on some common water-borne diseases, such as malaria and cholera. Currently, most health and hygiene education programs are aimed at women, as caregivers and managers of the household (WEDO, 2003).

In their roles as caregivers in household and natural resource managers, women are most affected by the current global water crisis. As the environment deteriorates, women's livelihoods become increasingly vulnerable because changes in the environment affect women and men differently in relation to coping strategies for example men will migrate in such of water sources for their livestock as women are left home with the burden of taking care of the household, planting and harvesting while at the same time competing for communal water resources with other men and women. Population growth is accompanied by a corresponding increase in the rate at which resources are used, including water. Achieving sustainable development will require comprehensive solutions to the interrelated challenges of rapid population growth, global environmental degradation and poverty. Ensuring women's reproductive health and rights is integral to this effort. This includes women's control over the number and spacing of children, maternal nutrition, prevention and treatment of sexually

transmitted diseases a large portion of monthly income; water cut-offs due to unpaid bills; lack of accountability mechanisms for users; deterioration of water quality; and hygiene issues. In some instances, poor and working women have been forced to decide between paying for water and feeding their children. Protests against the sale of public water services to multinational corporations have been mounted across the globe, as private sectors do offer water services but at hiked prices which women cannot afford. Equitable social development recognizes the need to empower women, to utilize water resources sustainably are of grave importance (WEDO, 2003).

## **5 GENDER AND RAINWATER MANGEMENT**

### **5.1 Purpose and objectives of the research on rainwater management**

This research examines rainwater management technologies adopted by farmers to make use of the little/excess water they receive from rainfall which varies over seasons. Rainwater management provides farmers with additional water supply for their crops, livestock and for their households and reduces the pressures of demand on surrounding surface and ground water sources especially during dry spells. Water scarcity affects the poor and the most vulnerable (women) as they are highly dependent on water resources for their crops, livestock and the households. There is need to integrate gender into rainwater management programs to be able to; empower poor farmers (especially women), reduce poverty, improve livelihoods and promote economic growth for farmers which are also the objectives of Millennium Development Goals (MDG's)

The objectives of this research are:

- To identify rainwater management technologies used by farmers and how these technologies have helped farmers improve the productivity of water for their crops, livestock and also for domestic use
- To carry out a gender research on rainwater management technologies. This was to identify if women have adapted to various technologies, was it difficult to adopt to a certain technology and what were the reasons for that and what are the outcomes and social and economic impacts of using these rainwater management technologies.

Rainwater management is defined as the conservation of water and soil, sustainable land management, rainwater harvesting, conservation agriculture and micro irrigation-management of water for crops, livestock, agro forestry and fish productivity (Merry and Gebreselassie, 2011).

### **5.2 Importance of rainwater management**

About 70 percent of the world's poor live in rural areas where livelihood options outside agriculture is limited. Many poor farmers rely on rain-fed agriculture for food, but variable rainfall, dry spells due to climate change make rain-fed farming a risky business (International Water Management Institute, 2007).

Better management of rainwater, soil moisture and supplemental irrigation is the key to helping poor farmers because:

- Rainwater management provides farmers with food security for their household through improving agricultural productivity in areas that depend on rainfall. Food security implies that they do not have to depend on foreign aid and also there is a notable increase in nourishment for households
- Rainwater management is important as it cuts the yield losses from dry spells. During dry spells most farmers account for losses in the yield production of crops as well as livestock. With rainwater management farmers have been able to apply rainwater harvesting techniques and grow crops even when there is minimal rainfall thus still being able to depend on agriculture as the main source of their livelihood
- It gives farmers the security to invest in other rainwater technologies such as conservation agriculture which needs inputs like herbicides. The herbicides are expensive but farmers consider it a wise investment because it provides high yields and incomes
- It provides farmers a chance to grow higher value market crops such as fruits and vegetables. Poor farmers have a chance to move away from low-value staple crops and earn high cash incomes. This breaks them off from the vicious cycle of poverty (International Water Management Institute, 2007).

### **5.3 Examples of rainwater technologies adopted in Africa**

Rainwater management technologies are used to collect, store rainwater, with the particular aim of meeting the demand for quality water by human and/or human activities. Rainwater management technologies provide farmers with additional water supply for their crops, livestock and for their households.

Agriculture is the most important economic activity in sub-Saharan Africa, supporting over 67 percent of the population with food and income. In East Africa, annual rainfall ranges from 150mm in the arid and semi-arid areas to over 2,000mm in the wet areas, mostly highland regions. Drought is a common phenomenon affecting 61-87 percent of the land in Ethiopia, Kenya and Sudan. Agricultural production in East Africa is below its potential and crop failure makes it impossible to provide adequate food security for the people living in these countries. Food insecurity and poverty are the greatest threats to sustainable development in Africa. Therefore, rain-fed agriculture needs to become a more productive activity in Africa (Mati Mbura, 2005).

The rainwater technologies adopted by African farmers include:

- Sand Dams
- Watersheds
- Conservation agriculture
- Terraces or bunds (e.g. fanya juu, stone and soil bunds)
- Shallow wells

### 5.3.1 Rainwater Harvesting

Rainwater harvesting is the collective term for a wide variety of interventions to use rainfall through collection and storage, either in soil or in man-made dams, tanks, or containers bridging dry spells that arise from climatic changes. The effect is increased retention of water in the landscape, enabling management and use of water for multiple purposes (UNEP, 2009).

Rainwater harvesting is an important aspect of rainwater management because:

1. With continued climate change, rainwater harvesting will continue to be an adaption strategy for people living with high rainfall variability both for domestic supply and to enhance crop, livestock and other forms of agriculture.
2. Rainwater harvesting provides additional water supply for farmers and their households and reduces the pressures of demand on surrounding surface and ground water sources especially during dry spells
3. Rainwater harvesting has been implemented in various countries such as Japan, which is vulnerable in emergencies such as severe floods, earth quakes which adversely disrupt water supply to the populations
4. Rainwater harvesting has in many cases not only increased human welfare and eco-systems services, but it has also acted as a way of improving equity, gender balance and strengthen social capital in communities. For example, increase in women's access to water has meant that they are able to save time and engage in other productive activities that earn them income (UNEP, 2009).

Rainwater harvesting consists of a wide variety of technologies used to collect, store and provide water with the particular aim of meeting the demand for water by human and/or human activities. These technologies can be divided into two;

1. *In situ* rainwater technologies are, soil management strategies, which enhance rainfall infiltration and reduce runoff. The in situ rainwater harvesting systems are often identical to a range of soil conservation measures, such as terracing, pitting, conservation tillage systems, commonly implemented to counter soil erosion.
2. *Ex situ* systems are defined as systems which have rainwater harvest capture areas external to the point of water storage. The rainwater capture area varies from being a natural soil surface with a limited infiltration capacity, to an artificial surface with low or no infiltration capacity. Commonly used impermeable surfaces are rooftops, roads and pavements which can generate substantial amount of water (UNEP, 2009).

The following rainwater harvesting techniques, examine gender integration, implemented in these techniques. Have women been able to adapt to these techniques? How have female farmers benefited; in terms of empowering women, and has this been a reducing poverty strategy for them to better their livelihood?

### 5.3.2 Conservation Agriculture

Conservation agriculture is defined as minimal soil disturbance (no-till) and permanent soil cover (mulch) combined with rotations, as a more sustainable cultivation system for the future. Conservation Agriculture provides knowledge and tools to enable farmers to achieve acceptable profits from high and sustained crop production levels while, at the same time, conserving resources (water) and protecting the environment (FAO).

Conservation agriculture is based on three principles:

- Minimal soil disturbance
- Maintenance of a permanent soil cover with mulch or cover crops
- Diversified crop rotation

Conservation agriculture aims to:

- Reverse soil degradation processes and builds up soil fertility by facilitating better infiltration of rainwater and enabling the recharge of groundwater which reduces erosion and leaching and in turn, water pollution.
- Improve growth conditions for crops, which will yield high produce for farmers at a low production cost
- Reduce crop vulnerability to extreme changes in climatic conditions. In wet conditions conservation agriculture facilitates infiltration, reducing the threat of soil erosion and downstream flooding. In drought conditions it reduces crop water requirement by 30 percent, makes use of soil water and facilitates deeper rooting of crops.
- Provide an opportunity to improve livelihoods for farmers, this is because it provides farmers with a chance to use their time doing other activities rather than spending time tilling the farms. Thus breaking away from the vicious cycle that binds them to poverty (FAO).

#### Gender and Conservation Agriculture (IIRR et al, 2005)

In Uganda for example, approaches taken by women to practice conservation agriculture may be limited because of the following reasons:

- Control of income by men: women's labor input into food production activities which is often not appropriately rewarded, since their husbands get to control all their income they receive from the markets. If women controlled their income, it would mean that they can purchase the equipment needed in conservation agriculture like fertilizers or herbicides.
- Decision making by what practice is best by men: Despite female farmers being the main contributors in agriculture, most of their contribution in agriculture remains unrecognized. Men continue to make the important decisions in the household without consulting women. Therefore they decide what agricultural practice works best for them and yet women carry out the heavy burden in the farms.
- Access and control of land: Most women do not enjoy equal and independent rights over the control and use of land. Women's access to the use of land is



determined by their husbands, who decide what agricultural practice they will use on their farms. Women farmers who prefer using conservation agriculture have a hard time convincing their husbands that this is a better technique to use than conventional agriculture.

- Labor: conservation agriculture in its initial stages requires farmers to put in a lot of hard work and time especially in the weeding process which is done frequently in the year. Most weeding is left to the female farmers who find this a challenge because they still have other roles to play in the household which are equally as important. Men do not help women during the weed processing stage which is labor extensive. Therefore, women opt not to adopt conservation agriculture because they have no support from their husbands in terms of labor and cannot afford to hire laborers. In other cases women farmers will opt to adapt to other methods used in conservation agriculture, but failing to adapt to all the techniques means that they do not fully benefit from conservation agriculture. In some parts of Ethiopia, female headed households who own land, have no labor to prepare land, for early plantation. This has resulted in them preparing their fields late and forced to share out their land and receive half or less of the production return.

Conservation agriculture may affect women and men in many different ways. This will influence whether or not they are willing to adopt the technique. Therefore, in East Africa there is need to review the benefits farmers will get from opting to adapt to conservation agriculture, especially for female farmers who contribute substantially to agriculture production (NORAD, 2011).

The benefits include:

- Improved yields: conservation agriculture facilitates timely planting, thereby reducing the risk of significant yield reductions associated with late planting which is often a common problem for farmers. Farmers may not reap the full benefits in the first year however, in the second year, there is an increased yield. This increase is of great importance to female farmers as it means improved nutritional status of household members and the sale of surplus production. Increase in yields also helps women pay for school fees, medical care and purchase agricultural inputs.
- Food security: Land preparation which is done by female farmers can start after the harvesting, when the land is not so hard. Early planting means that the farmers will benefit from the rain which is often not reliable and varies over seasons. Conservation agriculture acts as a buffer against the full impact of dry spells during the crop growing season by prolonging the period in which water is available for crops. In drier areas, rainwater harvesting also improves availability of moisture for crops
- Availing opportunities for off-farm income generating activities: under conservation agriculture time is saved as female farmers are more systematic on/in land management for land preparation through reduced labor

requirements for field activities, which enables farmers to engage in other income generating activities. For women, labor saving under conservation agriculture will allow them to engage in income generating activities like selling milk and eggs in the market and also allow them to take care of the household

In order for farmers to achieve the benefits of conservation agriculture there is need to address the challenges that come with the adoption of conservation agriculture which include:

- **Effective weeding:** one of the necessities of conservation agriculture is that, meticulous weeding must take place throughout the year and not just during the growing seasons. Research has shown that female farmers do not adhere to this because it is hard work and it takes up too much of their time, as that labor could be used to do other activities during the off-season. Conservation agriculture is thus considered an unnecessary burden despite its merits. Methods need to be considered to reduce the weed load on female farmers which includes the use of herbicides. However, this will need extensive training from extension agents. The most effective way is pooling labor this means that male farmers also get involved in the weeding process.
- **Poor access to markets:** poor access to input and output markets are a problem to farmers. There is lack of affordable conservation agriculture equipment (herbicides and fertilizers) that is useful to the farmers. It is also difficult to obtain seeds recommended for cover and rotation crops. Therefore, farmers need to be linked to commercial agro-dealers through developing rural outlets; this is also helpful where farmers are faced with infrastructural constraints. If farmers cannot sell their increased yields at a reasonable price then they will no longer see the need to practice conservation agriculture as it carries with it a lot of burden and it is also time consuming especially for female farmers.
- **Social and cultural issues:** men have a closed mindset towards conservation agriculture as they would prefer conventional agriculture which they have practiced for many years. Most farmers believe that ploughing is a prerequisite of planting without realizing the negative effects of conventional agriculture, worsened by climate variability and change which can be addressed to some extent through conservation agriculture application (IIRR, et al 2005).

### **5.3.3 Watershed Management**

A watershed is a basin-like landform defined by high points and ridgelines that descend into lower elevations and stream valleys. A watershed carries water “shed” from the land after rain falls which is channeled into soils, streams and rivers (Watershed Atlas). Watershed is a strategy which responds to the challenges posed by rain-fed agro-systems and human demand. These challenges include; low rainfall efficiency, water scarcity, poor management of water sources, land degradation due to soil erosion by water and acute fodder shortage and poor livestock productivity which is unable to cater for the growing population (UNEP, 2009).

Watershed programs are recognized as a potential engine for agricultural growth and sustainable development in rain-fed areas. The success of these programs highly depend on, collective action and the community's involvement (both women and men participation). For the community to fully benefit from watershed programs it is important to reach all the stakeholders (women and men) by ensuring that the program design itself is genderized. The issues of gender equity, community participation, sustainability and efficient use of conserved natural resources have not been addressed adequately by most watershed projects (Sreedevi, et al).

In Ethiopia for example, there exists a mixed crop livestock production system which is the main livelihood for the rural poor. The following are the problems identified by farmers in Ethiopia:

- Declining water quality and quantity affecting both humans and the livestock
- Decline in crop productivity due to dry spells and also low livestock productivity from limited feed
- Poor soil fertility due to intensive soil erosion and destruction of crops from uncontrolled runoff
- Decline in access to, and poor management of irrigation water and infrastructure
- Poor access to and dissemination of new technologies that will help farmers increase agricultural productivity (African Highlands Initiative, 2006).

To enhance gender inclusion and equity in watershed management, it is paramount to move beyond the standard participatory rural appraisal approach emplacing community participation during problem identification. There is need to explicitly manage gender and equity when structuring the community interface, eliciting views (during the stages of problem diagnosis, planning and monitoring) and negotiating benefits from watershed activities.

Considering gender and equity is required at all stages of watershed management; problem diagnosis, planning and monitoring, it is however only addressed in the planning stage. This problem is likely to stem from the transaction cost of socially informed and disaggregated monitoring and follow up as well as from conceptual barriers leading people to equate participation with attendance (African Highlands Initiative, 2006)

Watersheds programmes are primarily land-based and therefore male-focused given the control of land ownership by men. The focus on land development often gives projects a male orientation and predominance. This meant that the benefits received from water and land resources development were unequal between men and women. Therefore, these programs do not take into account the significant role women play in agricultural development. Women are passive decision-makers in the watershed programs and men generally take over the decision-making positions based on the fact that women do not own land therefore have no word. (Sreedevi, et al). Water sheds are

maintained by women who ensure that the household and livestock receive quality water. Although, women share a major workload for managing the natural resources, the benefits of the watershed programs largely by passed women like in countries Kenya and Ethiopia.

Dividing groups by gender or sex will give women an opportunity to bring out some of the issues that they face like ownership of land. Dividing groups into sub-groups also helps women provide facilitators with what needs to be changed to ensure adequate watershed development. Benefits of most watershed programs have been felt by both female and male farmers in terms of:

- Increased cropping intensity
- Reduced soil loss
- Growth of agriculture allied sectors and micro-enterprises,
- Conservation of rainwater and improved groundwater availability,
- Reduced migration (especially men) thus an increase in labor for farms
- Reduced number of people below poverty line (Wani et al. 2002, Kerr et. al.2000, and Joshi et al. 2004).

#### **5.3.4 Sand Dams**

A sand dam is a reinforced concrete wall built in a seasonal riverbed to capture and store rainwater beneath the sand, both filtering and protecting the water. A sand dam can hold two-ten million litres of water and is the world's lowest cost rainwater harvesting solution and has little or no maintenance (Excellent Pioneers). The sand dam can be further explained as a barrier in a drainage channel which holds sand and water on the upstream reservoir. It facilitates the percolation of water into the surrounding soil recharging the ground storage. The water moves backwards during the wet season and drains towards the channel during the dry season. Thus the sand dam regulates the water level in the river sands as well as the surrounding area. Water losses are minimal from a sand dam as the water is stored below the sand surface where evaporation forces are greatly reduced (SASOL, 2004).

Sand dams provide clean water to households, by protecting the water against contamination by livestock and prevent breeding habitats for mosquitoes that transmit water-borne diseases that would be deadly to children. The decision making process about where the sand dam should be located should involve the major stakeholders who would directly benefit from the sand dam. Therefore, both women and men should be active participants of the planning and implementation processes. This will mean equitable benefits for all the community members as they shared the cost of building the sand dam. Areas in Kenya like the North Eastern Province (Kitui) and areas in Southern Ethiopia (Borana zone) are constrained by water availability due to varying rainfall throughout the year. These are remote areas and therefore farmers find it difficult to access water for their crops and livestock which they highly depend on for

their livelihood. During the dry season they lack easy access to safe water and women and young children mostly girls have to walk to as close to ten to twenty kilometers to water sources (Rain Foundation).

It is important for women to have access to safe water as poor quality of drinking water results in serious health problems from diseases such as cholera and typhoid. Health issues will also be an added burden to women who have to care for the sick ones and use the little income they have to purchase medicine. It is important to note that water related diseases are among the major causes of child mortality in Africa (ADAPTS, 2011) Children in the Borana region for example, have the lowest school enrolment in Ethiopia because they are spending substantial amount of their time collecting water and still have other responsibilities like taking care of the livestock. The construction of sand dams in Ethiopia and Kenya has seen an increased enrolment of children in schools. Women have been able to save time and engage in other income generating activities. During the dry season women are most vulnerable to climate change, as they have the sole responsibility to provide food for the household this is an added burden to women. Women will have to depend on foreign aid but with the construction of sand dams, they still can depend on crop production and livestock production for their livelihood (Rain Foundation).

Table1 : Measured social and economic impacts of sand dams in the Kitui region, Kenya

Vulnerability Categories	Vulnerability Indicators	Before Dam Construction	After Dam Construction
Agriculture	Number of cash crops	1.5	3
	Percentage of irrigated crops	37	68
Special Aspects	Water collection for domestic use (minutes)	140	90
	Water collection for livestock (minutes)	110	50
Gender	Average walking distance for women to water source (Kilometer)	3	1
Economic	Income in US \$ Per Year	230	350
Health	Percentage of households suffering from malnutrition	32	0

### 5.3.5 Terraces

Terraces are an earth embankment or a combination ridge and channel, constructed across the field slop that intercepts, detains and safely conveys runoff to an outlet.

Terraces intercept runoff on moderate steep slopes. They transform long slopes into a series of shorter slopes. Terraces reduce the rate of runoff and allow soil particles to settle down. The resulting clean water is then carried off the field in a non erosive manner. Terraces can be used in areas where; soil erosion by water is a problem; excessive runoff is a problem and where there is need to conserve water (Dennis Carman).

Terraces are mostly effective if planned conservation systems are implemented, that includes a combination of practices like conservation agriculture and crop rotations. Examples of terraces used in water and soil conservation include:

- Storage terrace- collects water and stores it until it can infiltrate into the ground or is released into another outlet.
- Fanya juu terrace- is designed to act like a cut off drain, to hold or transport runoff water out of the field into a dam or a riverbed to be allowed to infiltrate thus increase water availability for crops and livestock. This technique is used by most Kenyan farmers
- Bench terraces-are level or nearly level steps constructed on the contour and separated by embankments known as risers. They can be formed by excavation or developed by fanya juu terraces

Women, particularly rural women in Kenya play a very important role in agricultural production; comprising of both food production; for household consumption and cash crops to supplement the family's income. Female farmers in Machakos District, Kenya for example have formed groups to ensure rainwater and soil conservation management is achieved. The major activity adopted by the female farmers in that area was terracing, that is, the fanya juu terraces (Margaret Kamar).

Factors that led to the adoption of this technique as a means of conserving rainwater and soil were:

- The need to conserve rainwater and soil was a major motivator: Unreliable rainfall in this area meant that there would be a shortage of water supply for households, farms and livestock. Agriculture is the main source of income for female farmers in this area therefore conserving rainwater was vital. Construction of a dam near terraces which acted like a cut off drain, to hold or transport runoff water out of the field into the dam is an added advantage
- Training, education and advice from extension agents provide female farmers in this area with sufficient knowledge on the best way of conserving rainwater which in other cases would not been take advantage of. This led to the adoption of terraces which brought about increased yields for the female farmers.
- Direct benefits of adopting this technique were also a motivator to the female farmers, these benefits included; adequate water supply for their crops and livestock, expected crop yields and increase in fodder even in the dry seasons.



Female farmers in this area also experienced setbacks while trying to adopt this technique:

- Unreliable rainfall within the region meant that there would be a shortage of rainwater; this reduced the speed in which women would have finished the project. Shortage of water also meant that the farmers would have to use their limited time to provide food for their households through other means which meant neglecting this project (terracing).
- Terracing requires a lot of labor, which either meant the female farmers would have to hire labor or ask their husbands to provide labor which usually meant that the male farmers would take over the decision making process on developing , redeveloping and maintenance of the terraces. Terracing is an expensive technique, and women lack access to income control within the household since men decide what the income will be used for, they may not be willing to support women and this technique.
- Women engage in multiple roles which may limit their participation in these groups, developing and redeveloping terraces and maintaining the terraces. Women's triple roles include; taking care of the needs of the family; they still have to care for livestock and their farms and also participate in community activities. This could be a setback in terracing development.
- Poor follow ups by the extension agents, affected the progress of the terraces. A follow up by the agents would provide information about new technologies they could also adopt and better this technique. The new ideas could lead to the female farmers trying out new crops in their farms to increase yields for the farmers (Margaret Kamar).

### 5.3.6 Shallow Wells

A shallow well is a hole that has been dug, bored, driven or drilled into sand or a rock, fitted with a hand pump to allow the extraction of water from shallow aquifers. The geographical characteristics, depths, diameter and shapes determine the volume and quantity and quality of water. Some shallow wells have a depth of up to 30 meters. Shallow wells are cheap to construct as compared to boreholes and it proves to be a reliable source of water supply for farmers. Shallow wells experience problems that demand attention; silting is one of the main issues especially during the rainy season, while sand storms cause wells to fill up with sand. Shallow wells also have the potential to collapse if the right equipment was not used during construction, which would mean losses to the farmers who invested in it. Another issue is pollution from chemicals used to treat livestock, herbicides, pesticides and detergents used for washing clothes that drain into the well especially during rainy season (ASC, 2009).

According to the United Nation World Food Programme, more than five million people across the Horn of Africa are facing a food shortage caused by severe drought, high food prices. The drought was brought on by failed rains at the end of 2010, resulting in substantial harvest failure for many communities, as well as deteriorating pasture

conditions and livestock losses. The current situation is only compounding the effect of the global food price crisis and regional drought of 2007-2009, which most affected communities are still recovering from since they are highly dependent on agriculture for their livelihood. This too has led to developing countries reaching out to developed countries for foreign aid (Food for the Hungry Relief, 2011).

Development of shallow wells in the Horn of Africa is on the rise as this has literally helped save lives and especially those of women. For example women in Turkana, in Kenya encouraged the construction of wells near the houses, because they will no longer need to make 15km journeys, alone and at risk of becoming innocent victim in the conflict over water. In a region like Turkana water sources like shallow wells are limited therefore; conflicts will arise over ownership rights, male domination of these sources, especially male livestock keepers (Practical Action). Female farmers however, have no decision making power to where the location of the shallow wells will be, due to the fact that access to water resources are directly linked to land rights, and in East Africa, women's right to own land or inherit land is restricted to local customs/laws.

Declining rainfall availability will strain agriculture and livestock production already hindered by land degradation. Male farmers will opt to migrate to other areas that are accessible to adequate water and pasture for their livestock, leaving women as the head of the household, assuming traditionally male farm responsibilities of farm management without having access to resources like credit, extension services and limited participation in water user associations in their region. This makes them more vulnerable to access shallow wells which may be owned by male farmers demanding a high payment to use the shallow well. Conflicts may rise over the control of community wells, especially during the drought season and women will less likely benefit from the shallow wells which would result in crop failure and limited water consumption for the household. Female farmers who own land can not afford to employ labor to help in the construction of shallow wells on their land; this is also a limitation to the adoption to this technique (Haile Tesfay, 2008).

Female headed households in Ethiopia are more prone to poverty than men headed households since women are less likely to seek employment options as men, due to their low level of education and women barely have any skills thus they are more likely to receive a lower pay and less skilled employment. This becomes a limitation as women will have limited income to join groups that wish to construct shallow wells in the community. The limited income will only be used in the household and in cases where the man is still present in the household then; women have limited decision on how they will spend the income. For female farmers in Ethiopia, the adoption of shallow wells has had an impact of improving household welfare and has reduced severe poverty. Female farmers have been able to adapt to irrigation systems with the use of shallow wells which has increased their workload but has created good opportunities for income generation from crop production. Shallow wells offer women an opportunity to

make a living and feed their family with the small area of land which they own through rain-fed agriculture (Haile Tesfay, 2008).

## 6 BIBLIOGRAPHY REFERENCES

African Studies Centre (ASC). 2009. Info sheet: Ignoring another inconvenient truth? Challenges in management Africa's water crisis.

(Available from <http://www.ascleiden.nl/Pdf/Infosheet5.pdf>) [Accessed on 20 April 2011]

Barbara Van Koppen. 2001. Empowering Women to Achieve Food Security. *Water Rights*.

(Available from [http://www.ifpri.org/sites/default/files/publications/focus06\\_03.pdf](http://www.ifpri.org/sites/default/files/publications/focus06_03.pdf)) [Accessed on 6 May 2011]

Carman Dennis. No date. Terraces. United States Development of Agriculture (USDA).

(Available from [http://www.sera17.ext.vt.edu/Documents/BMP\\_Terraces.pdf](http://www.sera17.ext.vt.edu/Documents/BMP_Terraces.pdf)) [Accessed on 16 April 2011]

Excellent Development Limited. No date. Pioneers of Sand dams.

(Available from [http://www.excellentdevelopment.com/uploads/Excellent%20Downloads/Excellent\\_Brochure\\_comb\\_web.pdf](http://www.excellentdevelopment.com/uploads/Excellent%20Downloads/Excellent_Brochure_comb_web.pdf)) [Accessed on 16 April 2011]

Food and Agriculture Organization (FAO). No date. Conservation Agriculture. *Conserving Resources Above- and Below- the Ground*. (Available from

<ftp://ftp.fao.org/docrep/fao/010/ai552e/ai552e00.pdf>) [Accessed on 6 April 2011]

Food for the Hungry Relief. 2011. Quenching Pastoralists "Thirst with Shallow Wells in Kenya". (Available from <http://fhrelief.wordpress.com/2011/04/07/quenching-pastoralists-thirst-with-shallow-wells-in-kenya/>) [Accessed on 6 April 2011]

International Fund for Agricultural Development (IFAD). 2007. Gender and Water – securing water for improved rural livelihoods: The multiple-uses system approach

(Available from [http://www.ifad.org/gender/thematic/water/gender\\_water.pdf](http://www.ifad.org/gender/thematic/water/gender_water.pdf)) [Accessed on 7 April 2011]

International Institute of Rural Reconstruction (IIRR) and African Conservation Tillage Network (A.C.T.) 2005. Conservation Agriculture: A manual for Farmers and Extension Workers in Africa. (Available from

<http://waswc.soil.gd.cn/books/1%20Conservation%20Agriculture%20Manual%20for%20Africa,%20IIRR%202005.pdf> ) [Accessed on 7 April 2011]

International Water Management Institute (IWMI). 2007. Water for Food Water for Life. A Comprehensive Assessment of Water Management in Agriculture. (Available from [http://www.fao.org/nr/water/docs/Summary\\_SynthesisBook.pdf](http://www.fao.org/nr/water/docs/Summary_SynthesisBook.pdf) ) [Accessed on 6 May 2011]

Global Water Partnership (GWP), 2000. Catalyzing Change: A handbook for developing integrated water management (IWRM) and water efficiency plans, technical committee. (Available from [http://waterwiki.net/images/9/9f/Catalyzing\\_change.pdf](http://waterwiki.net/images/9/9f/Catalyzing_change.pdf) [Accessed on 2 May 2011]

Gender and Water Alliance (GWA), Comprehensive Assessment of water management in agriculture (CA) and Both Ends (BE). No date. Making a difference in water management: A minimum agenda on gender mainstreaming for researchers, practitioners and gender experts. (Available from [http://www.swedishwaterhouse.se/swh/resources/20061024162559CA\\_Issue\\_Brief\\_3.pdf](http://www.swedishwaterhouse.se/swh/resources/20061024162559CA_Issue_Brief_3.pdf) ) [Accessed on 4 May 2011]

Gender and Water Alliance (GWA) and United Nations Development Programme (UNDP). 2006. Resource Guide: Mainstreaming Gender in Water Management. (Available from [http://www.wsscc.org/sites/default/files/publications/gwa\\_resource\\_guide\\_mainstreaming\\_gender\\_in\\_water\\_management\\_2006.pdf](http://www.wsscc.org/sites/default/files/publications/gwa_resource_guide_mainstreaming_gender_in_water_management_2006.pdf) ) [Accessed on 4 May 2011]

Joshi PK, Vasudha P, Shuferaw B, Wani SP, Bouma J and Scott C. 2004. Socioeconomic and policy research on watershed development in India: synthesis of past experiences and needs for the future research.

Kamar Margaret. Role of Kenyan Women's Groups in Community Based Soil and Water Conservation. A Case Study. (Available from <http://www.tucson.ars.ag.gov/isco/isco10/SustainingTheGlobalFarm/P219-Kamar.pdf> [Accessed on 21 April 2011]

Kerr J, Pangare G, Pangare V and George PJ. 2000. An evolution of dryland watershed development in India.

Lasage R, Seifu A, Hoogland M and A de Vries 2011. Adaption Strategies for River Basins: Adaptive Water Management at a Local Scale Ethiopia case study. (Available from [http://www.bothends.org/uploaded\\_files/Factsheet\\_Ethiopia.pdf](http://www.bothends.org/uploaded_files/Factsheet_Ethiopia.pdf)) Accessed on 22 April 2011]

Norwegian Agency for Development Cooperation (NORAD). 2011. Report from a fact finding mission: Women, Gender and Conservation Agriculture in Zambia. (Available from <http://www.norad.no/en/Tools+and+publications/Publications/Publication+Page?key=231729>) [Accessed on 12 April 2011]

Mbura Mati. 2005. Overview of Water and Soil Nutrient Management under A Smallholder Rain-fed Agriculture in East Africa. (Available from [http://www.iwmi.cgiar.org/publications/Working\\_Papers/working/WOR105.pdf](http://www.iwmi.cgiar.org/publications/Working_Papers/working/WOR105.pdf)) [Accessed on 12 April 2011]

Merry D and Gebreselassie T. 2011. Promoting improved rainwater and land management in the Blue Nile (Abay) Basin of Ethiopia. (Available from [http://mahider.ilri.org/bitstream/10568/3317/8/CPWFNile\\_Volume1.pdf](http://mahider.ilri.org/bitstream/10568/3317/8/CPWFNile_Volume1.pdf) [Accessed on 3 April 2011]

Practical Action. No date. Shallow Wells in Turkana (Available from <http://practicalaction.org/shallowwells>) [Accessed on 30 April 2011]

Rain Foundation. No date. A practical guide to sand dam implementation; water supply through local structures as adoption to climate change (Available from [http://www.rainfoundation.org/fileadmin/PublicSite/Manuals/Sand\\_dam\\_manual\\_FINAL.pdf](http://www.rainfoundation.org/fileadmin/PublicSite/Manuals/Sand_dam_manual_FINAL.pdf)) [Accessed on 26 April 2011]

SASOL Foundation. 2004. Kitui Sand Dams: Constructing and operation (Available from [http://www.samsamwater.com/projects/46/data/Sasol\\_-\\_2004\\_-\\_Kitui\\_sand\\_dams\\_Construction\\_and\\_operation.pdf](http://www.samsamwater.com/projects/46/data/Sasol_-_2004_-_Kitui_sand_dams_Construction_and_operation.pdf)) [Accessed on 26 April 2011]

Sreedevi TK and Wani SP. No date. Leveraging Institutions for Enhanced Collective Action through Harnessing Gender Power for Sustainable Development.

United Nations Development Programme (UNDP), Gender and Water Alliance (GWA) and Capacity Building for Integrated Water Resource Management (CARNET) 2006. Why Gender Matters: A tutorial for water managers. (Available from [http://www.unwater.org/downloads/why\\_gender\\_matters.pdf](http://www.unwater.org/downloads/why_gender_matters.pdf)) [Accessed on 11May 2011]

United Nations Educational, Scientific and Cultural Organization. 2004. Water and Ethics. Women and Water: An Ethical Issue. (Available from <http://unesdoc.unesco.org/images/0013/001363/136357e.pdf>) [Accessed on 12 May 2011]

United Nations Environmental Programme (UNEP). 2009. Rainwater Harvesting: A Lifeline for Human Well-Being (Available from [http://www.unep.org/Themes/Freshwater/PDF/Rainwater\\_Harvesting\\_090310b.pdf](http://www.unep.org/Themes/Freshwater/PDF/Rainwater_Harvesting_090310b.pdf)) [Accessed on 7 May 2011]

United Nations (UN). 2004. A Gender Perspective on Water Resources and Sanitation. (Available from [http://www.unwater.org/downloads/bgground\\_2.pdf](http://www.unwater.org/downloads/bgground_2.pdf)) [Accessed on 11 May 2011]

United Nations Millennium Task Force on Water and Sanitation. 2005. Health Dignity and Development: what will it take?

Wani SP, Pathak P, Tam HM, Ramakrishna A, Singh P and Sreedevi TK. 2002. Integrated watershed management for minimizing land degradation and sustaining Asia.

WHO, UNICEF, UNHABITAT, UNIDESA and UNEP. 2004. The Sanitation Challenge: Turning commitment into reality.

Women's Environment and Development Organization (WEDO), 2003. Untapped Connections. Gender, Water and Poverty: Key Issues, Government Commitments and Actions for Sustainable Development. (Available from [http://www.unwater.org/downloads/untapped\\_eng.pdf](http://www.unwater.org/downloads/untapped_eng.pdf)) [Accessed on 5 May 2011]